wherein said electrodes include a first electrode of a metal provided on a surface of said first substrate facing said second substrate and a second electrode of a metal provided on said surface with a separation from said first electrode, the separation creating a space which is part of the pixel, and

wherein said liquid crystal display device further includes a first region in said molecular alignment film in correspondence to said first electrode and a second region in said molecular alignment film in correspondence to said second electrode, said first and second regions being formed by ultraviolet irradiation and inducing said pre-tilt angle in said liquid crystal molecules located adjacent to said first and second regions.

REMARKS

Claim 1 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Applicants' admitted prior art ("the AAPA") in view of Walton et al. (U.S. 6,201,588) and Lien (U.S. 5,907,380). Applicants respectfully traverse this rejection because none of the cited references, whether taken alone or in combination, disclose or suggest first and second electrodes including first and second projections respectively, and made of a metal, as featured in claim 1 of the present invention, as amended.

Applicants maintain and incorporate herein by reference those arguments previously advanced on pages 4 through 7 of Amendment A, filed December 18, 2001. Applicants respectfully request that the Examiner reconsider those arguments in light of this

Amendment, as well as the following new arguments and expansions upon the previous arguments.

As noted by the Examiner on page 3 of Paper No. 10, the AAPA neither teaches nor suggests projections provided on electrodes. Furthermore, and as previously discussed, Walton does not provide pre-tilt locally to the respective electrodes. The Examiner cites only Lien for the teaching of a projection formed on an electrode to provide a local pre-tilt.

Lien though, actually teaches to form a step 64 on a substrate 22, and then form a pixel electrode layer 26' over both the step 64 and the substrate 22. (See FIG. 6A, and accompanying description). Lien teaches to form this step 64 from a transparent material such as a clear resin, a silicon oxide, or the equivalent (see col. 5, lines 44-49), or from a conductive polymer. (See col. 6, line 5). Lien nowhere teaches or suggests that the step, or any other projection, is formed from a metal. In fact, Lien here teaches away from using a metal to form the step 64.

In contrast, claim 1 of the present invention as amended recites, among other things, that the first and second projections are formed of a metal. As previously discussed, the metal projections are much easier to manufacture, and eliminate the need to use expensive transparent materials such as those taught by Lien. Accordingly, the rejection of claim 1 based on a combination of the AAPA, Walton, and Lien is respectfully traversed.

Claim 4 stands rejected under 35 U.S.C. 103(a) as being unpatentable over the AAPA in view of Rieger et al. (U.S. 6,180,026). Applicants respectfully traverse this rejection because neither of the cited references, whether taken alone or in combination, discloses or suggests a liquid crystal display ("LCD") device utilizing vertically aligned ("VA") liquid crystal molecules with the recited birefringence.

The Examiner notes on page 5 of Paper No. 10 that the AAPA does not teach the recited birefringence of claim 4 of the present invention. The Examiner cites only Rieger for disclosing such birefringence. However, Applicants respectfully point out that Rieger is drawn to a twisted nematic ("TN") device exhibiting positive dielectric anisotropy. (See col. 3, lines 55-57; col. 4, lines 28-29).

One skilled in the art is well apprised that TN devices typically have significantly slower switching times than VA devices, as well as the fact that TN devices and VA devices may not just simply be combined. VA devices also exhibit *negative* dielectric anisotropy, and not *positive* dielectric anisotropy as with the TN device specifically taught by Rieger. Accordingly, Rieger thus teaches away from the present invention. The rejection of claim 4 based on the combination of the AAPA and Rieger is therefore respectfully traversed.

Claim 5 stands rejected under 35 U.S.C. 103(a) as being unpatentable over the AAPA and Rieger, and further in view of Weber et al. (U.S. 5,374,374). Applicants respectfully traverse this rejection because claim 5 depends from independent claim 4, and therefore includes all of the features of the base claim, plus additional features. Accordingly,

this rejection is respectfully traversed for at least the reasons discussed above in traversing the rejection of independent claim 4. Moreover, Applicants respectfully point out to the Examiner that Weber, like Rieger, teaches only TN devices, and thus further teaches away from the VA device of the present invention.

Claim 6 stands rejected under 35 U.S.C. 103(a) as being unpatentable over the AAPA in view of Walton, Lien, and Yoshida et al. (J. Appl. Phys., Vol. 36 (1997), pp. 428-431). Applicants respectfully traverse this rejection because none of the cited references, whether taken alone or in combination, disclose or suggest that ultraviolet irradiation is selectively applied to first and second regions of a molecular alignment film corresponding to first and second electrodes formed of a metal, as featured in claim 6 of the present invention, as amended.

The Examiner acknowledges on page 7 of Paper No. 10 that none of the AAPA, Walton, or Lien teach to form regions which introduce the pre-tilt angle by ultraviolet ("UV") irradiation. Furthermore, similar to the discussion for claim 1 above, none of these three cited references teach or suggest that electrode regions for inducing a pre-tilt are formed from a metal. The Examiner cites only Yoshida for teaching UV alignment technology without use of the rubbing method.

Yoshida, however, merely teaches a uniform pre-tilt of liquid crystal molecules over an entire area of a pixel, and not selectively to first and second regions of the molecular alignment film, as in the present invention. In contrast, claim 6 of the present invention

features first and second regions of the molecular alignment film corresponding to first and second electrodes respectively, which electrodes are formed of a metal.

These distinct features of the present invention enable the molecular alignment film within the pixel area to avoid exposure to the UV irradiation, while also enabling the pre-tilt angle of the liquid crystal molecule within the visible pixel area to be small. These advantageous results further contribute to a very large contrast which can be achieved in the pixel area, and without sacrificing response speed of the liquid crystal panel. Yoshida neither discloses nor suggests the selective regions of the pixel, formation from a metal, or any of these featured advantages.

Furthermore, because pre-tilting of the molecular alignment film is provided selectively in the invisible area of the pixel (where the first or second electrode is provided), the present invention is also able to advantageously provide a large pre-tilt angle without affecting optical performance characteristics of the LCD panel. For these additional reasons, the Section 103 rejection of claim 6 based on the four cited references is respectfully traversed.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached Appendix is captioned "**Version with Markings to Show Changes Made**."

For all of the foregoing reasons, Applicants submit that this Application, including claims 1 and 4-6, is in condition for allowance, which is respectfully requested.

The Examiner is invited to contact the undersigned attorney if an interview would expedite prosecution.

Respectfully submitted,
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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claims 1 and 6 have been amended as follows:

1. (Once Amended) A liquid crystal display device, comprising:

a first substrate;

a second substrate facing said first substrate;

a liquid crystal layer interposed between said first and second substrates; and

a group of electrodes disposed on said first substrate so as to create an electric field in said liquid crystal layer generally parallel to said first substrate in an activated state in which a drive voltage is applied to said group of electrodes~~;~~,

said liquid crystal molecules aligning generally perpendicularly to a plane of said first substrate in a nonactivated state in which said drive voltage is not applied to said group of electrodes, said liquid crystal molecules aligning generally parallel to said plane of said first substrate in said activated state~~;~~,

said liquid crystal molecules having a pre-tilt angle of less than 90° in at least one of a part of said liquid crystal layer corresponding to a pixel and said electrodes on said first substrate,

wherein said electrodes include a first electrode of a metal provided on a surface of said first substrate facing said second substrate and a second electrode of a metal provided on said surface with a separation from said first electrode, the separation creating a space which is part of the pixel, and wherein said liquid crystal display device further includes a first projection provided on said first electrode and a second projection provided on said second electrode, said first and second projections inducing said pre-tilt angle in said liquid crystal molecules located adjacent to said first and second projections.

6. (New) A liquid crystal display device, comprising:

a first substrate;

a second substrate facing said first substrate;

a liquid crystal layer interposed between said first and second substrates; and

a group of electrodes disposed on said first substrate so as to create an electric field in said liquid crystal layer generally parallel to said first substrate in an activated state in which a drive voltage is applied to said group of electrodes; and

a molecular alignment film provided on said first substrate so as to cover said electrodes,

said liquid crystal molecules aligning generally perpendicularly to a plane of said first substrate in a nonactivated state in which said drive voltage is not applied to said group of electrodes, said liquid crystal molecules aligning generally parallel to said plane of said first substrate in said activated state~~;~~,

said liquid crystal molecules having a pre-tilt angle of less than 90° in at least one of a part of said liquid crystal layer corresponding to a pixel and said electrode on said first substrate~~;~~,

wherein said electrodes include a ~~fist~~ first electrode of a metal provided on a surface of said first substrate facing said second substrate and a second electrode of a metal provided on said surface with a separation from said first electrode, the separation creating a space which is part of the pixel, and

wherein said liquid crystal display device further includes a first region in said molecular alignment film in correspondence to said first electrode and a second region in said molecular alignment film in correspondence to said second electrode, said first and second regions being formed by ultraviolet irradiation and inducing said pre-tilt angle in said liquid crystal molecules located adjacent to said first and second regions.